REMARKS/ARGUMENTS

The application is amended herewith in a manner that is believed to place it clearly in condition for allowance at the time of the next Official Action at the time of the first examination on the merits of the present application.

For the Examiner's convenience, the following remarks are discussed in the context of the points raised by the Examiner in the Official Action of April 23, 2003 in the parent application.

DOAN et al. is directed to a method of avoiding buckling in a multilayer structure, in which a structural barrier film to maintain structural integrity is added next to a layer of for example, tetraethylorthosilicate "TEOS" that reflows (the layer's structural integrity is compromised during reflow) to prevent buckling.

DOAN et al. discloses that the structural film can be titanium nitride, tantalum nitride, titanium oxide, or tantalum oxide, among others (column 4, line 66, through column 5, line 22). That is, DOAN et al. suggests that a tantalum nitride film improves the structural integrity of an adjacent layer during reflow.

In contrast, an object of the present invention is to provide a semiconductor device, wherein a connection portion of a tantalum-base metal as a barrier metal film with a copper wiring

is improved in adhesion to prevent the copper wiring from peeling off, so that the semiconductor device is improved in reliability.

As shown in Fig. 7, the semiconductor substrate 1 is received in a chamber 15, and then subjected to a heat treatment at a temperature of approximately 400°C for approximately 20 minutes. As a result, the tantalum film 6 reacts with the copper thin film 9 to form therebetween the amorphous metal film 7 having a film thickness of approximately 20 angstroms. At the same time, the tantalum film 6 reacts with the silicon oxide forming each of the surface protection film 2 and the interlayer insulation film 3 to form therebetween the tantalum oxide film 11 having a film thickness of approximately several angstroms.

As described above, since the amorphous metal film 7 is formed between the tantalum film 6 and the copper thin film 9, the tantalum film 6 is brought into more intimate contact with the copper thin film 9. In the same way, since the tantalum oxide film 11 is formed between the tantalum film 6 and each of the surface protection film 2 and the interlayer insulation film 3, the tantalum film 6 is brought into more intimate contact with each of the surface protection film 2 and the interlayer insulation film 3.

Since the amorphous metal film is formed between the tantalum film serving as a barrier metal film; and, the conductive material (copper wiring) comprising copper or copper-

base metal as its essential component, the tantalum film is brought into more intimate contact with the conductive material. Consequently, it is possible to prevent the conductive material from peeling off, which improves the semiconductor device in reliability.

However, DOAN et al. neither teach nor suggest a three-layer-structure (barrier metal - amorphous - wiring structure) which brings a more intimate contact between the tantalum film and the conductive material (copper wiring).

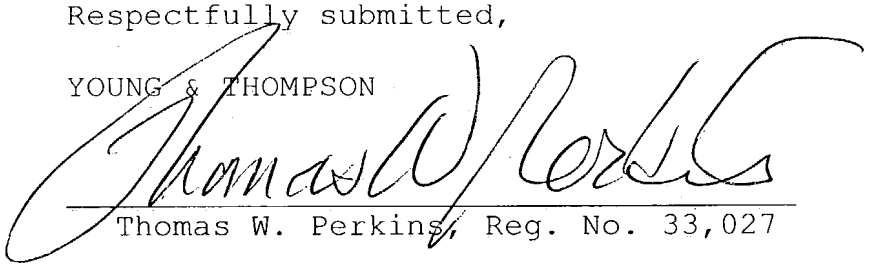
In addition, DOAN et al. neither teach nor suggest that the amorphous metal film is formed by a reaction between the tantalum film and the conductive material (copper wiring).

TING et al. neither teach nor suggest the above.

Consideration and allowance of the claims are respectfully requested.

Respectfully submitted,

YOUNG & THOMPSON



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